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stract universals,' being the 'effects' of countless simpler objects which a misleading terminology has labeled 'mere sensations,' 'feelings' and the like. If this forecast rings riddlesome here it is probably because the fallacies of conventional psychological language have not been appreciated. But that it is the consistent implication of modern empiricism, I have little doubt.

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REVIEWS AND ABSTRACTS OF LITERATURE

Logic, Deductive and Inductive. JOHN GRIER HIBBEN, Ph.D., Stuart Professor of Logic in Princeton University. New York: Charles Scribner's Sons. 1905.

The task of preparing a modern text-book in logic lays under large contribution the resources of the historical and scientific as well as of the philosophic spirit. To rehabilitate what remains of the traditional formal logic that is worth preserving and handing down to another generation, to search out and to systematize essential methods or tools of scientific procedure, often employed as they are almost unconsciously and in fields remote and technical, and finally, to bring home to the student a fruitful conception of the philosophical significance of logic, a realization of its catholic scope and abiding interest as an inquiry into the dialectic, the drama of thought itself—these are concerns which the maker of a text-book on logic may be expected to reckon with. This much, at least, must be said in appreciation of the many-sided and comprehensive treatment which logic has received at the hands of Professor Hibben in his book on 'Logic, Deductive and Inductive.'

It would be difficult to think of a logical topic of any importance that does not receive attention in these pages. The reader renews acquaintance with the ancient forms of traditional logic and observes with interest how greatly some of them have been rejuvenated by the garb of modern instances and unworn illustrations. The author is to be congratulated on the success with which the 'stock examples which have grown old and infirm in the service of many generations of students in logic,' to quote from the preface, have been eliminated, and their places supplied by illustrations and examples 'taken from the sphere of every-day experiences, in order that they may represent modes of actual reasoning pursued by the common run of mankind.' It has been the aim of the author, we also read in the preface, 'to present in connection with the more formal and traditional treatment of the deductive logic also some considerations which have been contributed by the discussions of the modern logic and which find expression in such works as those of Sigwart, Lotze, Erdmann, Green, Bosanquet, Venn and others.'

The book, as a whole, consists of two parts, the Deductive and the Inductive Logic. The latter part is a revision of the author's 'Inductive Logic' which was published in 1896.

Part I., the 'Deductive Logic,' opens with a series of chapters on the nature of thought, the concept, and the judgment. The wisdom of dwelling in advance and at some length on the nature of thought is easily apparent, although the definition of thought laid down at the outset be confessedly incomplete, if not unduly one-sided and abstract. "Thinking . . . may be defined in one of its aspects at least as the process of interpreting the special by the general, or the new experience by the old" (p. 4). True, inasmuch as 'thinking' is to be the subject-matter of the whole book, it may well be let off with a very incomplete account of itself in the first chapter. But stripped of its antecedents and occasions, broken off short on its stem, it presents, in spite of a suggestive illustration which I have not the space to quote, a rather limp and devitalized appearance, as if chilled by the rigor of the severely logical atmosphere into which it has been suddenly thrust. It is considerably thawed out and revived, however, through well-chosen illustrations in the immediately following discussion of the four functions involved in reflection: (1) The formation of concepts out of the 'crude data of knowledge furnished by the senses.' (2) 'The reduction of the total mass of concepts to some kind of systematic order.' (3) Interpretation—the referring of the object of thought to its appropriate concept. (4) Inference—the process of unfolding what is implied in judgments.

In these introductory chapters judgment, of course, is given the central place. It is made clear that the concept can lead only an empty and precarious existence unless employed in the act of judging, in the act of qualifying, or interpreting, some object of thought, whether perceptual or conceptual. Considerable space is devoted to the drawing of distinctions between the empirical and the logical concept, emphasizing the growing loss of particularity on the part of the latter, its freedom from dependence upon any mental picture to make it clear and intelligible, its tendency to progressive differentiation, and its highest development in the form of a constructive principle, or true scientific concept. No constructive function is ascribed to the logical concept in its lower, more nearly empirical form. We are told that this higher order of concepts in virtue of having a constructive function is radically distinct from the other orders. But is not this failure of the logical concept to come into its own until so late in its career due not to its earlier proximity to empirical concept, but to its artificial isolation from it?

Berkeley's contention, that the loss of particularity on the part of the concept tends to reduce it to a dead and empty form, is answered by Professor Hibben in a way that recalls Mill's famous definition of matter. "The particular attribute of color, or of form, or of habit is indeed dropped out of mind in framing the concept, but there is always a compensation for the loss of the particular by substituting in its place the possibility, not only of the attribute in question, but all others of the same general kind. Instead of the particular we have the potential which admits of an indefinite degree of variation. Thus the concept of a rose admits of any shade of color whatsoever which is compatible with the whole range of experience regarding roses" (p. 17). In other words, the concept is, among other things, a sort of permanent possibility of images, as matter—according to Mill's definition—is a permanent possibility of sensations.

The various types of judgments—universal, singular and negative—and the varieties of judgment forms—categorical, hypothetical and disjunctive—receive ample description and illustration. It is worth noting that the latter are treated genetically as various stages in the progress of knowledge. The discussion of division and classification is enriched by the presentation for comparison of Bacon's classification of human knowledge and Comte's and Spencer's classifications of the sciences.

This brings us to an important chapter on the nature of inference. Professor Hibben undertakes to maintain throughout his treatment of inference a sharp distinction between the psychological and the logical, between inference as a psychical experience, as something going on in some one's mind, open to observation and description, and inference as having validity, warrant, ground. The chapter opens with a very brief but admirably clear statement of the psychology of inference as rooted in the perceptual processes. Soon the question of the objective validity of these processes arises. The shade of Hume is invoked. Refuge is finally sought in 'the fundamental postulate of knowledge which we are constrained to assume, namely, that our consciousness must be self-consistent throughout' (p. 90), and in the assumption that the data of consciousness contain *within themselves* that which enables the mind to transcend them. In two or three places in this chapter the distinction between the psychological and the logical shows signs of becoming a division of labor rather than a barrier, but one dare not urge this point very far, lest it turn out to be a case of 'subjective necessity' rather than a case of 'objective validity.'

Most of the remainder of the deductive part is taken up with explanation of the more typical aspects of formal logic, the 'laws' of identity, contradiction, excluded middle and sufficient reason, the various transformations of the judgment forms, the syllogism with its mood and figure. There is a chapter on extra-syllogistic reasoning, and one on fallacies. It is an evidence of a very high order of ingenuity that the author should have succeeded in squeezing out of the various combinations and permutations of *A, E, I, O* two practical suggestions, one of them aimed against hasty generalization, and the other a useful rule in debate—'never attempt to prove more than is necessary to overthrow your opponent's main contention' (p. 109).

Part II., the 'Inductive Logic,' is introduced by a discussion of the relations between induction and deduction, in which it is made clear that Professor Hibben desires the student to understand thoroughly that the two are mutually dependent. The premises of deduction are not given ready-made, but must be constructed by us through our interpretations of reality. Mr. Bradley's argument that there can be no such thing as induction, because it always rests on an implied universal which gives to the process as a whole a deductive character, is taken by Professor Hibben to have the force 'only of proving that induction can not be independent of deduction' (p. 173). A chapter is devoted to each one of Mill's five inductive methods. Under predication and verification the author treats of the tendency of laws or generalizations reached through inductive processes to become anticipatory. Thus science escapes the bounds of Baconian induction. It is largely through these anticipations that the progress of science is attained. The chapter following is naturally, one might say logically, devoted to the hypothesis. The double function of the hypothesis is clearly brought out—how it functions preliminary to experiment as a selecting agency, and how it functions subsequent to a problematic occurrence as an explanatory, unifying agency. It is noted how large a part is played by the imagination in the development of a hypothesis, Tyndall's thesis to this effect in his discussion of the 'Scientific Use of the Imagination' being well illustrated by quoting an instance of one of his own scientific explanations. Following the chapter on the hypothesis is a chapter on analogy, in which the important rôle analogy has played as an instrument of discovery and of classification in scientific research is made clearly evident, and five requirements of true analogy duly set forth. Corresponding to the discussion of extra-syllogistic reasoning in Part I. is a discussion, under the head of probability, of cases that are so complex that they can not be subjected to the ordinary inductive methods. Inductive fallacies are comprehensively discussed under the four rubrics of errors of perception, errors of judgment, errors of the imagination and errors of the conceptual processes. They are characterized as 'due to the psychological disturbance of our normal logical processes.' We are told that the chapter is devoted to the pointing out of errors that are mainly psychological in their origin, for two reasons. First, because the data of inference are psychological as regards their source; if observation and sense-perception be contaminated, all the subsequent processes of hypothesis, classification, etc., will suffer accordingly. Second, fallacies that are formal are not so apt to mislead. 'In the material data especially lurk the germs of fallacy.'

The book closes with a chapter on the inductive methods as applied to the various sciences, and with a historical sketch of induction, which goes back to Socrates, Plato and Aristotle, and which contains brief accounts of the logical significance of Roger Bacon, Da Vinci, Telesius, Campanella, Locke, Newton, Herschel and Whewell, as well as of Francis Bacon and John Stuart Mill. A list of nearly two hundred brief logical exercises is appended. Special mention should also be made of the abundant and interesting illustrative material in Part II., much of it drawn from the experimental sciences and adding not a little to the teaching value of the book.

The function of the book is clearly to serve as a comprehensive textbook or manual, a museum of the past and a field survey of the present. So completely has this function been fulfilled, so close and faithful is its exposition, especially of the present position of what is commonly regarded as logical theory, that the book has more than a pedagogical significance. It has succeeded so well that it can hardly fail to challenge criticism, the criticism of that which it has exposed.

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The Color Sensitivity of the Peripheral Retina. JOHN WALLACE BAIRD. Washington: Carnegie Institution. 1905. Pp. 80.

This paper commences with a summary of the experimental work done on the sensitiveness of the retina to color, which may be called as good as perfect. It is concise and gives the gist of each of the experiments in their chronological order and with careful references to the original places of publication. Two general conclusions can be drawn from this mass of work: "All colors tend to assume a yellowish or a bluish tint as they approach the periphery; yellow and blue do not themselves change in tone, but the less refrangible end of the spectrum—the reds, the oranges and the greens—together with the more reddish purples, appear more and more yellowish as they recede from the visual axis; while the more refrangible end of the spectrum—the violets—together with the violetish purples, pass over into bluish or even blue, at but a slight distance from the fovea. . . . The saturations of all color stimuli appear to diminish gradually and steadily, from the fovea to the outer limits of vision; in addition to the yellow and the blue, a certain tone of red and a certain tone of green undergo no change of color in indirect vision." The three experimental papers, by Bull, Hess and Hegg, which have observed all the necessary precautions, show, furthermore, that 'the retinal sensitivity to a certain red is coextensive with that to a certain green; the sensitivity to a certain yellow is coextensive with that to a certain blue; the former pair of color zones is much narrower than the latter pair.'

It seems also well established that all the color zones increase with an increase in the saturation, area and intensity of the stimulus. In fact, "the more recent workers at least, are of the opinion that even the peripheral retina is not, strictly speaking, color-blind. Its 'color sense' may be so weak that a relatively strong stimulation is required to call forth the whole manifold of sensation qualities which it is capable of furnishing; but that it may, under appropriate conditions, furnish the same quality series as the more acute central regions is no longer doubted." This should seem to bear interestingly on von Kries's theory of peripheral vision, and Baird does not hesitate to say that 'it seems evident throughout that the behavior of the eccentric regions of the retina has given von Kries an endless amount of trouble; and his own discussion shows that his theory is wholly inadequate to account for the phenomena in question.'

The experimental portion of Baird's paper deals with two questions, the chromatic character of the sensation aroused when a constant color stimulus is applied successively to different regions of the retina, and the relative extension of the retinal areas within which the tones of the different color stimuli are correctly recognized. The list of the various